Measurement of Double Helicity Asymmetry in Multi-Particle Productions at PHENIX

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Polarized deep inelastic scattering experiments revealed that the contribution of the quark spin ($1/2 \cdot \Delta\Sigma$) to the proton spin is only 20-30%. The remaining component can be carried by the gluon spin (Δg) and the orbital angular momenta of the quarks and gluons ($L_{q,g}$); $1/2 = 1/2 \cdot \Delta\Sigma + \Delta g + L_{q,g}$. One of the goals of the PHENIX experiment is to obtain Δg, which can be evaluated by measuring double helicity asymmetries (A_{LL}) in longitudinally-polarized proton-proton collisions.

We are measuring A_{LL} in multi-particle production that originates from jet at mid rapidity. This measurement will give us higher statistics in the higher transverse-momentum (p_T) region than that in single particle measurements. Photons and charge particles are measured with the PHENIX Central Arm detector. Particles that satisfy experimental selections with a high-p_T (> 2 GeV/c) photon existing in event are clustered by a cone method. The cone radius R ($= \sqrt{(\Delta\phi)^2 + (\Delta\eta)^2}$) is set to 0.3, and the transverse momentum of the cone ($p_T^{\rm cone}$) is defined as the vector sum of the transverse momenta of the particles in the cone; $p_T^{\rm cone} \equiv |\sum_{i \in {\rm cone}} \vec{p}_{Ti}|$. The relationship between $p_T^{\rm cone}$ and $p_T^{\rm jet}$ is evaluated with PYTHIA and GEANT simulations.

In this presentation, A_{LL} and cross section analyses with Run 2005 data, which is of $\sim$2.7 pb^{-1} luminosity and $\sim$46% polarization, will be discussed.